BASELINE CLIMATE AND AIR QUALITY FOR BLM LANDS IN WYOMING

SCIENCE APPLICATIONS, INC.

BASELINE CLIMATE AND AIR QUALITY FOR BLM LANDS IN WYOMING

In Response to:

Preliminary Task Order
YA-510-PH9-41

Contract YA-512-CT7-26

Submitted to:

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1. INTRODUCTION

The following technical proposal has been prepared in response to the BLM preliminary task order No. YA-510-PH9-41 for a baseline climate and air quality study for BLM lands in Wyoming dated March 21, 1979. The following sections discuss the technical approach which will be utilized by Science Applications, Inc., (SAI) in the conduct of a program designed to characterize the climate, dispersion meteorology, air quality and emission levels for BLM lands statewide and in each of 12 BLM Wyoming Resource Areas. The final analysis will be suitable for the development of district and area office planning analyses, Environmental Statements (ES), Unit Resource Analyses (URA) and Environmental Assessment Record (EAR) sections.

The final report to be prepared by SAI will be slanted toward mineral extraction activities where appropriate (e.g., dispersion meteorology). The analysis will be based upon a literature search of the latest available historical data in an effort to maximize the credibility of the analysis. The analysis will be responsive to appropriate BLM Manual Section requirements (e.g., 1605: Unit Resource Analyses). SAI recognizes the interdisciplinary nature of the task order and considerable interaction with BLM-Wyoming specialists is anticipated.

The following sections describe the manner in which the SAI analysis will be responsive to the objectives specified in Section F of the preliminary task order. These objectives include (1) the description of the existing climatology, dispersion meteorology, emissions and air quality of the 12 BLM Wyoming Resource Areas; (2) a compilation and assessment of air quality and meteorological monitoring in Wyoming; (3) a compilation and assessment of present and projected emission sources in Wyoming;

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

(4) a bibliography of all data sources; (5) a glossary of technical terms; (6) a review of available raw data and (7) the provision of all study data to BLM in readily usable form.

The proposal is divided into seven major sections. Section 2 describes the manner in which data will be compiled and evaluated from the numerous sources which will be contacted during the course of the study. The characterization of the climate and air quality for BLM land in Wyoming is described in Section 3. Section 4 provides a detailed review of the techniques to be employed in the development of the regional dispersion potential. Emphasis will be placed on low level non-buoyant sources in the development of this section as these are felt to be indicative of mineral extraction activities. The data bibliography and the glossary of terms are described in Sections 5 and 6 of the proposal while man-hours and materials are presented in Section 7.

Resumes for selected staff personnel are presented at the end of the technical proposal. These individuals represent personnel with experience in the conduct of programs for the BLM who are also uniquely familiar with conditions across the state of Wyoming. Mr. W.P. Lynott, the proposed Project Manager, has served as Project Manager for four other completed or ongoing studies being conducted for the BLM under the present Basic Ordering Agreement with SAI. As such, he is intricately familiar with BLM procedures and goals and will provide overall direction for the proposed effort. Mr. H.J. Frentz will serve as the Principle Scientist on the program and he also possesses considerable experience on both BLM programs and other projects currently being conducted by SAI within the State of Wyoming.

2. DATA COMPILATION AND EVALUATION

The following sections discuss the manner in which SAI will respond to the objectives established in the preliminary task order for the compilation and evaluation of climatological, meteorological, air quality and emissions data suitable for subsequent use in BLM planning activities in Wyoming. The sources of data available for the project include all academic, private and governmental programs involved with data collection in and around the State. While this will include both summarized and raw data, the analyses will be based solely on the use of summarized data. Raw data will be described in the bibliography and recommendations will be made regarding its usage. Analyses conducted for the Southwestern Wyoming Coal ES Region, the Southcentral Wyoming Coal ES Region and the Eastern Powder River Coal ES Region will serve as important data sources. The evaluation of the suitability of the identified data will deal with areas such as (1) spatial coverage, (2) temporal significance, (3) commonality and (4) data adequacy.

2.1 CLIMATOLOGICAL DATA

Climatological data are available for Wyoming from many sources. The National Weather Service (NWS), the Department of Energy (DOE), the National Climatic Center (NCC), the University of Wyoming, the United States Forest Service (USFS), the United States Environmental Protection Agency (USEPA) and private industry serve as primary data sources.

In Wyoming, the most extensive data base will be available for the population centers. Basic climatological data will be available for these and rural areas from the types of stations discussed in Table 2-1. These stations range from simple precipitation storage gages to detailed climatological recording programs at major airports and/or NWS installations. Figure 2-1 displays the distribution of sources of climatological data for

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Table 2-1
Spectrum of Stations Monitoring
Climatological Data*

Symbol	Parameter(s) Measured
○ ● ◑	Precipitation Only
⦶	Precipitation, Storage
	Precipitation and Temperature
	Precipitation, Temperature and Evaporation

Type of Gage:

● Recording

○ Non-Recording

◑ Both Types

◎ More Detailed Meteorological Data (e.g., wind speed, direction, etc.)

⦶ Storage Gage

* This table constitutes the legend for Figure 2-1

Figure 2-1

Distribution of Climatological Data in Wyoming

Wyoming as described in Climates of the States.[1] The density of coverage indicated on Figure 2-1 will be increased by the addition of data available from the sources described earlier. The bulk of the required climatological data, however, will be available in reduced form from the NCC. SAI will acquire published data whose availability is described in the report prepared by the NCC staff.[2]

Figure 2-1 indicates that considerable data on precipitation and temperatures will exist in the area. In the more populated areas, sources of extensive, continuously recorded meteorological data can be expected which will provide much of the data discussed in Table 2-2. This serves to illustrate the point that subjective analysis will be required in computing average and extreme values for more rural locations.

Table 2-2 lists the climatological parameters which will be compiled and evaluated together with the types of summaries which are most pertinent for each parameter. For the purposes of this proposal, climatological parameters are those which are not directly related to the development of a dispersion meteorology. These latter parameters will be referred to as meteorological and will be discussed in Section 2.2.

An intensive evaluation of the data will follow and, to a certain degree, assist the compilation phase. The first mode of evaluation actually works hand-in-hand with the establishment of the data base. The spatial array of the available data must be made for the parameters of interest. The suitability of the spatial array will largely be a function of the homogeneity of the terrain and the climate. The suitability of an individual source of data could be limited, for example, in an instance where (1) blocking terrain limits the interaction with nearby areas or (2) different meteorological regimes are known to exist in a nearby area in spite of the relative homogeneity of the local terrain.

Table 2-2

Climatological Data Summaries

for BLM Lands in Wyoming

PARAMETER	TYPE OF DATA REQUIRED
oud Cover and Sunshine	Monthly, seasonal and annual averages.
aporation	Monthly and annual averages and extremes of pan evaporation. Ratio of pan to lake evaporation rates (annual). - PET.
g	Seasonal and annual frequencies of occurrence.
ost-Free Period	Dates of last killing frost in spring and first in fall. Isolines will be provided at 10-day intervals.
il	Average monthly totals. Review of historically damaging hailstorms.
midity	Monthly, seasonal and annual averages.
infall	Mean annual precipitation depicted by isohyets at half inch intervals. Monthly and growing season means and extremes. Rainfall frequency-intensity maps (isopluvials) for 30-minute, 6-hour, 12-hour and 24-hour rainfall periods for 2-year, 10-year, 25-year and 50-year return periods. Review historical occurrence of floods. Historical occurrence of droughts and probability of reoccurrence. Review of historically damaging or severe dust storms.
duced Visibility ther than fog)	Seasonal and annual averages.
il Temperature	Seasonal and annual averages and extremes.
lar Insolation	Seasonal and annual averages of solar radiation (direct and diffuse) received on a horizontal surface.
	Seasonal and annual average number of hours of sunshine (represented as the percentage of possible).
owfall	Monthly and annual averages and extremes. Maximum seasonal snowpack depth. Annual number of days with 1-inch or more snow cover. Review of historically damaging blizzards.
mperature	Monthly and annual mean, maximum, minimum and extreme (record) temperatures. Review of unusual temperature patterns. Annual averages of heating and cooling degree days. Monthly and annual temperature at 700 mb and 500 mb.
understorms	Monthly and annual frequency distribution.
rnadoes	Monthly and annual frequencies.
	Relate historical data to Fujita scale. Review know tornado tracks.
nd	Monthly and annual wind roses.
	Monthly and annual cumulative frequency distributions of wind speed. Monthly and annual wind roses at 700 mb and 500 mb levels. Persistence of winds in excess of 20 mph, 30 mph, and 40 mph. Highest recorded wind speeds. Review of historically damaging or severe events. Seasonal overlays showing areas experiencing chinook, katabatic and drainage winds and areas of possible stagnation.

Recent data!

The establishment of the optimum spatial array of data will also be assisted by the analysis of the climatological significance in temporal terms for each data base. It is generally felt that a minimum of five years and preferably ten years of data are required before a source of data is climatologically significant, i.e., indicative of long-term trends. Data for lesser periods of time (>2 years) are also used but mainly in instances where no other suitable data are available for a given area.

The commonality of the data base is also a key factor in that climate tends to be cyclical on a long-term basis; hence, two sources of data whose period of record varies by 20 years or more, are not desirable, especially when the total length of record is less than five years. As a result, the establishment of the data base for BLM lands in Wyoming will be based upon climatologically significant and temporally consistent data, to the degree permitted by the availability of data. In instances where data not consistent with these requirements are used, a discussion will be provided on the suitability of such data in terms of the overall climatological data base.

Once the data base has been optimized in terms of spatial array, climatological significance and commonality, a discussion of the overall adequacy will be provided as a function of the individual climatological parameters discussed previously. In this manner, areas for which subjective techniques will have to be applied to develop estimated ranges of the subject parameters will be identified. Discussions will be held with the BLM COAR to finalize the subjective analyses.

2.2 METEOROLOGICAL DATA

Meteorological data suitable for the development of a dispersion climatology are available for Wyoming from the NCC. These data include (1) surface wind speed and direction data

(available for several of the stations represented in Figure 2-1), (2) atmospheric stability data generated from surface observations, (3) temperature inversion types and frequencies, (4) winds and temperatures aloft and (5) mixing heights. Complete data on items 2 through 5 will be limited. However, partial data will be available from many area stations. If some parameters are not covered within the study area, data from the nearest station outside the study area will be utilized.

possibly outside the state

Hourly surface wind speed and direction data are stored at the NCC. Some of these data are available in summarized form in joint frequency distributions of wind speed, wind direction and atmospheric stability class. The latter parameter is developed utilizing wind speed, cloud cover, ceiling height, latitude and time of day for a given station. The joint frequency distribution is referred to as a STAR (STability ARray) program and is very appropriate for air pollution studies. Many such programs have already been run by the NCC, and STAR programs can be prepared for other NWS stations by the NCC upon request. SAI also has the capability to develop STAR programs utilizing the NCC methodology.

The NCC prepares summaries on types and frequencies of temperature inversions and maintains data on winds and temperatures aloft. Again, additional summaries can also be prepared by the NCC upon request. Finally, mixing heights can be developed in two ways: (1) Holzworth(3,4) has prepared national and regional summaries based upon temperature sounding data and (2) the parameter can be developed on an hourly basis utilizing the daily temperature soundings in conjunction with hourly surface temperatures. Holzworth(3) has also computed averages of the mean wind speed through the mixing layer as well as a summary of slowest dilution (stagnation) episodes at selected stations in the contiguous United States.(5)

As with the climatological data, an evaluation of the meteorological data will follow the compilation phase. However, in this case, the availability of data is the limiting factor. In most cases, all available data suitable for the development of a dispersion climatology must be used. For example, the spatial array of meteorological data is usually quite limited and must be supplemented if at all possible. Upper air data can only be supplemented through the collection of additional field data, which is not the purpose of the present program.

The development of a dispersion climatology is not always afforded the luxury of long-term sources of data suitable for compliance with the tenets of climatological significance. However, long-term data will be stressed in the development of the data base. Much of the STAR data presently available through the NCC is for the period 1960 to 1964. This provides both climatological significance and commonality. Important data collected at other NWS stations or private programs for different sampling periods can also be used, provided they are related by a comparative analysis. For example, if data for 1975 are available from private industry while ten years of data (e.g., 1955-1964) are available for a nearby airport, an analysis can be conducted which compares data for selected days in 1975 at each location (i.e., the airport has continued to collect data but only the indicated 10-year period had been summarized). Such an analysis indicates the suitability of the briefer and more recent data for the overall analysis. SAI does not plan to utilize the comparative technique but rather will depend upon data available for climatologically significant periods.

Once the spatial coverage, climatological significance and commonality have been established, a discussion of the overall adequacy of the data will be provided. The development of subjective values for the meteorological parameters will be finalized in discussions with the BLM COAR.

2.3 AIR QUALITY DATA

Ambient air quality data for BLM lands will be compiled by SAI utilizing data from federal, state and local regulatory agencies as well as data collected by private industry within the region. The key pollutants include (1) sulfur dioxide (SO_2), (2) nitrogen oxides (NO_x), (3) carbon monoxide (CO), (4) total suspended particulates (TSP), (5) non-methane hydrocarbons (NMHC), and (6) ozone (O_3). Other contaminants of interest include lead, hydrogen sulfide (H_2S), and sulfates. Most of the available data will be for TSP, with SO_2 being the next most commonly recorded parameter. It is unlikely that the other parameters will be monitored at more than a maximum one or two locations in each resource area.

The emphasis on the air quality data base will be to collect a minimum of one year of the most recent data available within the area. However, in some areas it will be desirable to present data from briefer monitoring programs where coverage is limited. The spatial coverage will be as dense as the availability of data permits while temporal significance in the climatological sense decreases in importance. The data base need only be long enough to provide annual averages from a recent period. Recent data are important to insure that the existing regional trends in pollutant levels are quantified. Commonality of data is essential as data collected at the same location several years apart will often show considerable variability. The evaluation of the data base will conclude, as in the previous cases, with a discussion of the adequacy of the ambient air quality data base followed by the development of subjective values of the existing pollutant levels in remote areas. This will be accomplished through discussions with the BLM COAR at a meeting to define similar values for the climatological, meteorological and emissions parameters.

2.4 EMISSIONS DATA

SAI will compile pollutant emissions data on a county-wide (area) and major source-specific basis for the area utilizing data available from federal, state and local control agencies as well as from private industry within the study region. County-wide annual tonnage emission rates are available from the USEPA for the five primary contaminants TSP, SO_2, NO_x, HC and CO. In addition, the USEPA maintains inventories of pollutant emission rates and plant locations for the aforementioned contaminants for major point and area sources. SAI will also work with industry to ascertain diurnal and seasonal trends in the emission rates and to acquire source exit characteristics. Key stack exit parameters include (1) stack height, (2) inside stack diameter, (3) exit temperature, (4) exit velocity and (5) emission rate. SAI will also work with industry and BLM to arrive at realistic estimates of source strength and exit characteristics for new or modified facilities.

A discussion of uncertainty in the emission rates will be provided together with a review of the adequacy of the overall data base. Uncertainties in emission rates and exit characteristics will impact future modeling analyses based upon the subject study. Emission rate changes are linearly related to predicted pollutant ground level concentrations and modifications to the estimated emission strength can easily be incorporated. Changes in the exit characteristics impact plume rise in a non-linear fashion and also impact the predicted ground level concentrations. The reliability of the emissions data provided in the baseline study will be clearly defined.

3. CHARACTERIZATION OF CLIMATE AND AIR QUALITY

The following paragraphs discuss the manner in which SAI proposes to characterize the climatology and existing ambient air quality for BLM lands in Wyoming. Existing conditions are being documented to (1) provide a basis for evaluating future pollutant impacts resulting from development of resources on federally-held lands and (2) provide a data base from which to optimize resource management techniques. The data will be suitable for use in ES sections. The data will be presented in a graphics intensive manner (tables, figures, graphs, etc.) using a consistent map scale in the case of all figures. A master overlay will be provided for each resource area and statewide depicting local topographic features using height contours. A detailed discussion of topographical features will be provided for each resource area. Data will be presented in English units but metric conversion factors will be provided to facilitate conversion. Finally, data sources and emissions sources will be presented graphically. Tables?

3.1 CLIMATE

SAI will provide a thorough documentation of climatological conditions in Wyoming for use in evaluating their effect on alternative land uses with emphasis on mineral extraction. As appropriate for each climatological parameter discussed in Table 2-2, monthly, seasonal and annual means and extremes will be prepared and presented as appropriate in tables and graphs. BLM will provide input on sunshine and cloud cover, evapotranspiration and growing season.

As indicated in Section 2.1, published data available through the NCC will serve as the primary data base with supplemental data to be obtained from other regional sources to improve the spatial array. It is anticipated that the available data will not be sufficient for some parameters. Subjective analyses

Comparative analysis.

will be required to complete the regional distributions, particularly in areas of mostly heterogeneous terrain. Development of values in these areas will be finalized upon completion of discussions with BLM technical staff. However, the analyses will be based upon the information presented in Table 3-1.

Once the analyses have been prepared for the complete gamut of climatological parameters, a narrative will be provided relating the results to the concepts of resource management with emphasis on mineral extraction. Specifically, what limitations does the existing climate impose on various land usages and what types of planned anthropogenic development will impact the micro-, meso- and macro-scale climate? Table 3-2 lists a preliminary review of the potentially limiting effects of the primary climatological parameters as well as the potential impacts of land use and development on these parameters.

A discussion will also be provided on the suitability of climatic subdivision schemes (e.g., NWS techniques) to characterize portions of the State. Homogeneous areas will be grouped into appropriate climatic subdivisions to provide for easy identification of the general climatological conditions expected in each area. The appropriate BLM Manual forms can also be completed if desired by the COAR.

3.2 AMBIENT AIR QUALITY

The existing air quality within the area will be characterized in terms of the existing regulations established by federal, state and local regulatory bodies. SAI will provide a complete review of the applicable rules and regulations. These standards will be summarized for the resource areas and will include a review of all standards including the Standards for the Prevention of Significant Deterioration (PSD) and the requirements of the 1977 Amendments to the Clean Air Act. BLM will provide data on Non-Attainment areas, Air Quality Maintenance Areas (AQMA) and Class I PSD Areas.

Table 3-1

Basis for Subjective Analysis of Climatological Parameters in Areas of Rugged Terrain

PARAMETER	BEHAVIOR
TEMPERATURE	• Diurnal and annual ranges larger in sheltered (valley) locations • Decreases with increase in altitude at a rate of roughly 5.5°F per 1000 feet.
PRECIPITATION	• Increases with increase in elevation with largest values on windward slopes due to orographic lifting. • Decreases on the leeward side of mountain ranges due to "rain-shadow" effect. • Decreases with distance from water bodies.
SEVERE WEATHER (Thunderstorms, tornados, hailstorms and tropical storms)	• Wind effects greater at lower elevations in most cases (exception: "foehn" winds) while precipitation extremes more likely at higher elevations
HUMIDITY, FOG AND DEW POINT	• Higher in early morning and during winter • Higher near bodies of water • Higher at lower elevations
REDUCED VISIBILITY (other than fog)	• In dry areas, high wind speeds will result in reduced visibilities due to windblown dust • Occurs in conjunction with regional stagnation and the accumulation of pollutants • Occurs locally in early morning, due to accumulation of suspended particulate and other airborne materials in stable, surface inversion layer. • Occurs at higher humidities
EVAPORATION & EVAPOTRANSPIRATION	• Increases with higher wind speeds, low humidities and strong insolation
SOIL TEMPERATURE	• Maxima and minima most extreme near the surface with ranges decreasing with depth and extremes lagging those observed at the surface • A function of exposure and soil composition
INSOLATION	• Increases with decreasing latitude • Decreases with increasing cloud cover and precipitation • Dependent upon exposure
SKY CONDITIONS	• More cloudiness near bodies of water (particularly stratiform) • Cumuliform activity increases over elevated terrain • Fog and low clouds more common over valley floors during early morning hours
BAROMETRIC PRESSURE	• Actual station pressure decreases with altitude • Corrected to mean sea level, barometric pressure is more variable in the mean storm track which on average is located at higher latitudes within the United States

Table 3-2

Limiting Aspects of the Primary Climatological Parameters and the Potential Impacts of Land Development

PARAMETER	LIMITING EFFECTS	POTENTIAL IMPACTS OF DEVELOPMENT FOR THE USES DEPICTED IN EXHIBIT A
TEMPERATURE	• Length of the growing season • Extreme values impair outdoor activity	• Destruction of natural vegetative cover would change the albedo of the surface and tend to permit more extreme values
PRECIPITATION	• Regulates the type and quantity of crops which may be raised • Drought occurrences severely impair land usage in terms of grazing and agriculture	• Considerable development would be required to bring about small changes in annual totals • A change in the vegetative cover, particularly in areas of higher terrain, could decrease average snowpack accumulation and effect spring and summer water availability.
SEVERE WEATHER	• Rarely sufficiently frequent to impair outdoor activity	• Little or none
HUMIDITY	• Extreme dryness limits agriculture and grazing	• Changes in the vegetative cover will have microscale effects on the relative humidity (e.g. loss of trees would result in lower humidities with larger range)
EVAPORATION	• Same effects as observed for low humidities are caused by high evaporation rates	• Evaporation rates increase in the absence of protective vegetative cover

Air quality summaries will include (1) annual maxima, (2) arithmetic or geometric annual means with standard deviations, (3) concentrations exceeded 10%, 50% and 75% ~~of the time,~~ annually, (4) frequency of standards violations and (5) seasonal means and maxima. In the case of particulate data, a review of size distributions and chemical composition will also be provided. Existing pollutant levels for the study area will be established.

If appropriate, air basins will be identified based on an analysis of topography coupled with observed climatological trends. Figure 3-1 provides an example of a preliminary air basin analysis prepared for Wyoming and displays how meteorological and air quality data can be displayed concurrently. The analysis also provides an indication of the degree of interaction anticipated between air basins. BLM Manual forms can also be completed, if appropriate.

A key aspect of the characterization of the existing air quality will be the identification of excellent air quality areas. These areas represent natural resources which must be clearly identified. The analysis will also strive to develop air quality trends within the area, particularly areas of decreasing air quality such that planned industrial development in these areas will be closely scrutinized and land uses which may result in air quality enhancement may be encouraged. Finally, existing and projected pollutant levels will be discussed in terms of the potential impact on Wyoming flora and fauna.

3.3 EMISSIONS

Emissions data will be summarized and comparisons will be provided with observed baseline air quality levels. The main pollutants of interest include SO_2, NO_x, TSP, CO, NMHC and O_3. Emission levels for these pollutants will be categorized for

STAR DATA

SO_2 DATA

PARTICULATE DATA

1-9 DESIGNATED AIR BASINS

DEGREE OF INTERACTION BETWEEN AIR BASINS:

GOOD INTERACTION

LITTLE INTERACTION

Figure 3-1
Functional Air Quality Map for the State of Wyoming

major existing and approved future point and area sources. These include but are not limited to:

- Sawmills
- Cement Plants
- Processing Plants
- Petroleum Distillation Plants
- Smelters
- Dumps
- Agricultural Burning
- Heavy Vehicular Traffic
- Power Plants

These data will be supplemented with county-wide annual emission rates and a regional pattern of actual emission strengths versus observed pollutant ground level concentrations will be developed. Source data will be provided by the BLM while analyses and text are to be provided by SAI. Data on particulate size distribution and chemical composition will also be reviewed. [BLM Manual forms can also be utilized, if appropriate.] ?

Difference between source & emission data

4. REGIONAL DISPERSION POTENTIAL

The regional dispersion potential in Wyoming will be developed to provide a basis for determining the probable impact (orderly to) of the development of federally-administered land areas. The following sections discuss the principles of dispersion climatology and discuss the presentation of the key parameters (1) atmospheric stability, (2) the depth of the mean mixing layer and (3) the mean wind speed through the mixing layer.

The dispersion climatology, coupled with the compiled data discussed in Section 2.2, will provide the BLM with a solid basis from which to launch possible subsequent modeling efforts designed to quantify the expected pollutant ground level impact for specific sources. The dispersion climatology will describe "typical" and "worst-case" meteorological conditions for the types of sources discussed in Section 3.3 for appropriate averaging periods. However, emphasis will be placed on low-level, non-buoyant sources indicative of mineral development activities. Regional transport will be depicted by trajectory analyses designed to show the prevailing flow in the resource areas on a seasonal and annual basis and the resulting potential for source interaction.

4.1 GENERAL DISPERSION CLIMATOLOGY

Dispersion climatology provides an evaluation of the capability of the atmosphere to disperse airborne effluents in a given geographical region. That capability depends largely on the three critical meteorological parameters previously noted. The topography of the region also plays an important role. The dispersion potential tends to be poorest in valleys, especially where the ends are restricted, and best on hilltops, sea coasts, and other exposed locations.

The ability of the atmosphere to disperse airborne effluents can be discussed in terms of atmospheric stability. When the atmosphere is stably stratified, the impact of ground-level, non-buoyant emissions, such as vehicular exhausts, will be greatest as both vertical and lateral diffusion are restricted. Emissions from tall stacks under such conditions will have little or no impact at ground level as the plume remains relatively intact aloft. Intense surface heating results in considerable convective activity and unstable conditions. Under such conditions, vertical diffusion is considerable and "fumigation" can occur as emissions from elevated sources are brought rapidly to the surface creating maximum ground-level impact. Important ground level concentrations attributable to tall stacks can also occur when mixing in the vertical is limited by the presence of a stable layer aloft. This situation is known as "trapping." Finally, neutral stability, indicative of a windy, well mixed atmosphere, and generally indicative of good atmospheric dispersion, can result in locally high ground-level concentrations for stacks of intermediate height or stacks whose height is not substantially greater than the surrounding building heights. In such cases, strong winds bring the plume rapidly to the surface resulting in high pollutant ground-level concentrations in a condition known as "downwash." In summary, the effect of atmospheric stability on the dispersion of airborne effluents is strongly dependent on the effective release height.

Regional pollutant buildups will occur during periods when the mixing height is restrictive and the wind speeds are quite low or non-existent. These periods are called stagnation episodes and can result in generally high pollutant levels within an air basin or series of interactive air basins. In the present analysis, these periods will be of considerable interest.

4.2 ATMOSPHERIC STABILITY

The dispersive power of the atmosphere can be subdivided into seven classes, labeled stability categories, in accordance

with a method proposed by Pasquill[6] and modified by Gifford[7] and Markee.[8] Pasquill's first three categories, A, B, and C, range from extreme to slight instability. Category D represents neutral or well-mixed conditions, while E and F represent slight and moderate stability, respectively. Dispersive power decreases with progression through these classes. Markee has further divided the original category F into categories F and G, with G representing extreme stability.

Typical monthly and annual values of this parameter will be developed utilizing available STAR data. Hourly observations from the NWS stations for which atmospheric stability has been developed, together with such data from private industry or special government sources, if available, will be used to develop the averages. Distributions of atmospheric stability will also be provided in the form of joint frequency summaries with the parameters wind speed and direction. These summaries are readily available from the NCC for major airports located in the study area. The resulting characterization of atmospheric stability will be discussed in terms of the general dispersion characteristics presented in Section 4.1. SAI summarization tables will be provided as will the BLM Manual forms, if appropriate.

4.3 MIXING HEIGHTS

The mixing height indicates the volume of air available for the dispersion of airborne effluents. A typical scenario finds mixing heights to be lowest during the early morning hours due to the presence of a surface or low-level inversion. As surface heating progresses during the morning hours, the surface inversion is eroded and finally dissipated. However, an elevated, subsidence inversion often exists at higher levels. Thus, as the mixing height improves or increases, it is usually still limited, although to a much lesser degree, by the presence of the elevated inversion. Seasonally, mixing heights tend to be lowest in fall and winter and highest in summer.

SAI will categorize the mixing heights for Wyoming in terms of morning and afternoon values on a seasonal and annual basis. Inversion types and frequencies are integrally related to the characterization of mixing heights. As a result, SAI will also characterize the inversion climatology for each resource area utilizing the data described in Section 2.2. The analysis will provide seasonal and annual averages of inversion strengths (ΔT between base and top of inversion) and base heights for the morning and afternoon hours. The analysis of both mixing height and inversions will also quantify regional variations of these parameters in an effort to identify potential problem areas.

4.4 AIR MOVEMENT PATTERNS

The regional transport of airborne effluents is a function of both surface and upper level winds. Surface wind roses will be provided on a seasonal and annual basis for locations with available data. Wind roses for the 700 mb and 500 mb levels will also be provided where the data are available. In addition, a trajectory analysis will be prepared based upon the utilization of all the available surface data. An example of the proposed trajectory analysis is presented in Figure 4-1 for the Puget Sound area of Washington. Such an analysis will be prepared for 0300, 0900, 1500 and 2100 MST for the four seasons and annually in the resource areas.

The surface trajectory analysis will be supplemented by the data on the mean wind speed through the mixing layer as prepared by Holzworth.[3] These data provide morning (12Z) and evening (00Z) values on a seasonal and annual basis. Though they are presented independent of wind direction, once coupled with the data presented on mixing heights, they provide information on the periods of slowest dilution potential for Wyoming.

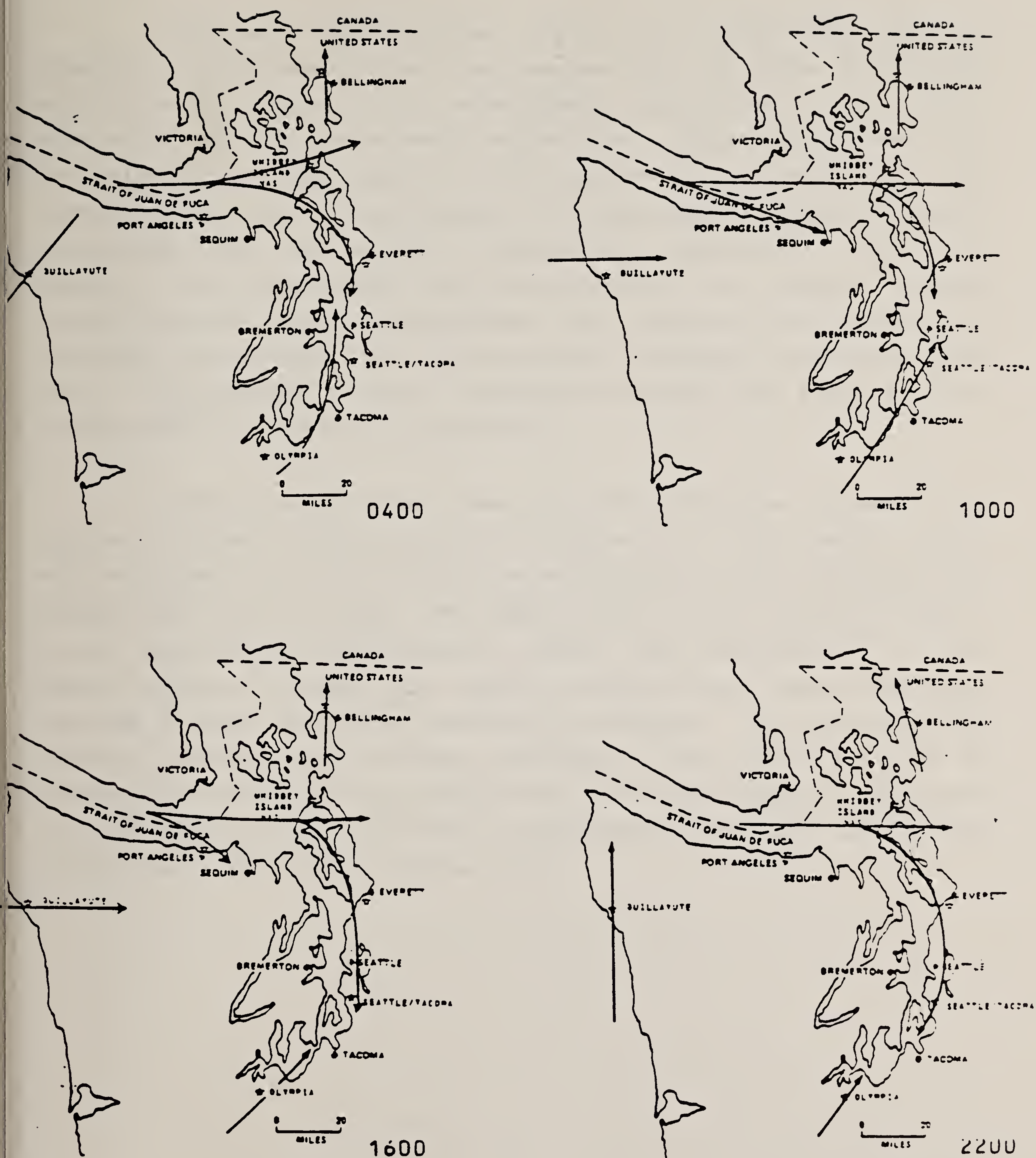

Figure 4-1
Surface Trajectory Analyses for the Summer Season
(Local Standard Time)

4.5 TYPICAL AND WORST-CASE CONDITIONS

SAI will characterize typical and worst-case meteorological conditions for various sources such as those associated with possible future land development activities in the study area with emphasis on mineral extraction. These conditions will be selected on the basis of the information provided in the preceding sections. For example, limiting conditions for surface activities such as mineral extraction include (1) low wind speeds, (2) persistent wind directions, (3) shallow mixing heights and (4) stable conditions. The frequency of typical and limiting conditions will be described utilizing available STAR data. The frequency of air pollution episodes as summarized by Holzworth[5] will also be presented.

Worst-case diurnal summaries will also be prepared for typical sources as illustrated in Table 4-1. This sample table was developed utilizing hourly meteorological data from stations having STAR data through the application of the WINDOW[9] model in an application described by Lynott and Sheridan.[10] The model marches through the entire hourly data base computing running 24-hour simulated pollutant averages. In selecting the highest average, the program provides a true indication of an historical worst-case by maximizing the simultaneous occurrence of wind speed, wind direction, atmospheric stability and mixing height for a particular source type.

Table 4-1

Recommended Worst-Case Meteorology

24-HOUR AVERAGING PERIOD[a]

TIME	WIND DIRECTION[b]	WIND SPEED[c] (mps)	STABILITY	MIXING HEIGHT[d] (m)
1800	16	6.9	D	1314
1900	16	4.4	E	1243
2000	16	2.8	F	1171
2100	16	4.4	E	1100
2200	16	6.9	D	1029
2300	16	6.9	D	957
0000	16	6.9	D	886
0100	15	6.9	D	814
0200	16	4.4	D	743
0300	16	2.8	E	671
0400	16	4.4	D	600
0500	16	4.4	D	700
0600	16	4.4	D	800
0700	16	6.9	D	900
0800	16	6.9	D	1000
0900	16	6.9	D	1100
1000	16	4.4	D	1200
1100	16	4.4	C	1300
1200	15	4.4	D	1400
1300	15	4.4	D	1500
1400	16	4.4	C	1600
1500	15	2.8	B	1529
1600	16	2.8	C	1457
1700	16	4.4	C	1386
3-HOUR AVERAGING PERIOD[e]				
1700	7	2.8	E	871
1800	7	2.8	E	829
1900	7	2.8	E	786

[a] Data taken from April 15-16, 1963.

[b] 01 = North, continue clockwise.

[c] Wind speeds represent median values for National Climatic Center wind speed classes.

[d] Mixing heights taken from Holzworth for indicated season [see footnotes (a) and (e)].

[e] Data taken from February 10, 1963.

5. BIBLIOGRAPHY OF ALL DATA SOURCES

A complete bibliography will be provided for all air quality, emissions, meteorological and climatological data available in Wyoming. BLM will provide partial input to this portion of the program. The bibliography will review the status of the data base including the following information:

- Availability - Public/Proprietary
- Status - Raw/Reduced/Summarized
- Applicability - BLM Lands/Other
- Time Period - Climatological Significance
- Completeness - Continuous/Sporadic
- Projections - Program Completed/Program Ongoing

This information will assist the BLM in an evaluation of the availability and suitability of the data as the need arises for its future use.

The data bibliography will be contained in the inventory report which will provide a complete review of summarized data. Raw data will be described in a separate bibliography together with a review of the data type, status, etc. SAI will provide the BLM with copies of all data collected in conjunction with the program in the form obtained by SAI. That is, digital data will be provided either on magnetic tapes or in the form of card decks while paper copy will be provided for all other summarized data. Raw data will not be collected by SAI and hence will not be provided to BLM. Modification of data collected by SAI in digital form during the conduct of the program to a format other than that utilized by SAI is felt to be beyond scope of the present program. Accordingly, authorization from BLM would be required in order to (1) change the format of the digital data as acquired by SAI or (2) to digitize paper copy data for BLM in a "common or universal" format.

6. GLOSSARY OF TERMS

SAI will review the final baseline documents and prepare a complete list of terms to be defined in the glossary. The glossary will be sufficiently complete to allow non-technical BLM and other personnel to interpret all findings contained in the document. To this end, an effort will be made to limit the usage of obscure technical jargon in the writing of the baseline documents.

7. MAN-HOURS AND MATERIALS

7.1 PROGRAM WORK STATEMENT

SAI will perform the following tasks in completing the objectives outlined in the preliminary task order. The tasks constitute parts of a program designed to characterize baseline climatological, meteorological, air quality and emissions data for BLM lands in Wyoming. The results will be contained in Final Reports which will consist of the items listed below. These data will be suitable for local planning analyses and incorporation in subsequent ES documents.

1) <u>Compilation and Evaluation of Available Climatological, Meteorological, Air Quality and Emissions Data</u>

   a) Compilation of available climatological data from the NWS, NCC, governmental agencies, private industry, academic institutions and other appropriate sources for the following parameters: (1) barometric pressure, (2) sky cover, (3) dew point, (4) evapotranspiration, (5) fog, (6) frost-free periods, freeze data and the growing season, (7) hail and ice, (8) humidity, (9) rainfall, (10) visibility, (11) soil temperature, (12) solar radiation, (13) snowfall, (14) temperature, (15) thunderstorms, (16) tornadoes, (17) heating and cooling degree days, (18) floods, (19) droughts, (20) blizzards, (21) dust storms and (22) high wind events.

   b) Compilation of available meteorological data from the sources listed in 1.a. for the following parameters: (1) surface wind speed and direction, (2) atmospheric stability, (3) temperature inversions, (4) winds and temperatures aloft, (5) mixing heights, (6) wind persistence, (7) peak winds, (8) topographically induced wind flows, (9) air sheds, (10) transport winds and (11) typical and worst case pollution dispersion conditions.

   c) Compilation and evaluation (for quality assurance) of available air quality data from the USEPA, State of Wyoming, private industry and other appropriate sources for the following parameters: (1) TSP, (2) SO_2, (3) NO_x, (4) NMHC, (5) O_3, (6) sulfates and others covered by current federal, state and local regulations.

d) Compilation of available emissions data from the sources listed in 1.c. above for the following parameters: (1) TSP, (2) SO_2, (3) NO_x, (4) HC and (5) CO for major point sources on a district-wide basis.

Data on exit parameters for major point sources will also be provided including (1) stack heights, (2) inside stack diameters, (3) exit temperatures, (4) exit velocity and (5) emission rates.

e) Evaluate data from the viewpoint of (1) spatial coverage, (2) temporal coverage and significance, (3) commonality, (4) adequacy, (5) uniformity and (6) representation.

2) <u>Characterize the Climate Utilizing Maps, Tables, Graphs, etc. as Appropriate</u>

a) Provide a complete discussion of the existing climate based upon the following data summaries (as permitted by data availability):

(1) Cloud Cover - monthly, seasonal and annual averages;

(2) Evapotranspiration - monthly and annual averages and extremes of pan evaporation rates; the ratio of pan to lake evaporation rates on an annual basis. Compare to precipitation by months showing deficits and surpluses;

(3) Fog - seasonal and annual frequencies of occurrence;

(4) Frost-Free Periods - dates of first and last killing frost as defined by 16^oF, 20^oF, 24^oF, 28^oF and 32^oF minimums. Length of mean growing season depicted by isolines at 20-day intervals, with more detail in areas strongly influenced by topography;

(5) Hail Events - average monthly occurrence and severity. Review of historically damaging hailstorms including location and duration;

(6) Humidity - monthly, seasonal and annual averages;

(7) Rainfall - mean annual precipitation depicted by isohyets at 0.5-inch intervals. Monthly and growing season means and extremes. Rainfall frequency-intensity maps (isopluvials) for 30-minute, 6-hour, 12-hour and 24-hour rainfall periods for 2-year, 10-year, 25-year and 50-year return periods;

(8) Visibility - seasonal and annual visibility averages in miles;

(9) Soil Temperature - seasonal and annual averages and extremes;

(10) Solar Insolation - seasonal and annual averages (Langleys). Seasonal and annual percentage of possible hours of sunshine;

(11) Snowfall - monthly and annual averages and extremes (water equivalent). Maximum seasonal snowpack depth. Annual number of days with one inch or more of snow cover;

(12) Temperature - monthly and annual mean, maximum, minimum and extreme (record) temperatures and the existence of unusual temperature patterns;

(13) Thunderstorms - monthly and annual frequencies;

(14) Tornadoes - monthly and annual frequencies. Relate historical data to Fujita scale. Provide map with historical review of known tornado tracks;

(15) Heating and Cooling Degree Days - annual averages;

(16) Floods - Historical occurrences;

(17) Droughts - Historical occurrences and probability of reoccurrences;

(18) Blizzards - Review of historically damaging or severe blizzards;

(19) Dust Storms - Review of historically damaging or severe dust storms;

(20) High Wind Events - Review of historically damaging or severe events.

b) Discuss the observed climatological characteristics of each resource area or district in terms of possible future land uses with emphasis on minerals extraction activities.

c) Discuss the usefulness of climatic subdivisions to collectively describe climatologically similar resource areas.

3) <u>Characterize the Dispersion Meteorology</u>

a) Provide a complete discussion of the existing dispersion potential based upon the following data summaries (as permitted by data availability):

(1) Surface wind speed and direction (mph/16 cardinal directions) - monthly and annual cumulative frequency distributions of wind speed. Monthly and annual wind roses;

(2) Atmospheric Stability - Monthly and annual Pasquill frequency distributions. Joint frequency distributions with wind speed and direction;

(3) Inversions - types and frequencies on a seasonal and annual basis during the morning and afternoon hours;

(4) Winds and Temperatures Aloft - Annual and monthly wind roses at the 700 mb and 500 mb levels. Annual and monthly temperatures at 700 mb and 500 mb levels;

(5) Mixing Heights - Morning and afternoon averages on a seasonal and annual basis;

(6) Wind Persistence - Period of time with wind speeds in excess of 20 mph, 30 mph and 40 mph;

(7) Peak Winds - Highest recorded wind speeds;

(8) Topographically Induced Wind Flows - Seasonal overlays showing areas experiencing chinook, katabatic and drainage winds, and areas of possible stagnation due to topographic and meteorological factors;

(9) Air Sheds - Existing air sheds as defined by topographic features;

(10) Air Movement Patterns - Streamline analyses for 0300, 0900, 1500, and 2100 MST on a seasonal and annual basis;

(11) Typical and Worst-Case Conditions: Frequencies of typical and worst-case conditions based on seasonal and annual STAR data with appropriate regional maps displaying the frequency of occurrence of such conditions. Develop a worst-case 24-hour scenario for a surface, non-buoyant release utilizing hourly STAR data. Indicate the frequency of air pollution stagnation periods.

b) Discuss the observed dispersion meteorology characteristics of each resource area in terms of possible

future land uses with emphasis on mineral extraction activities.

c) Discuss the usefulness of an air basin approach to collectively discuss meteorologically similar resource areas.

d) Discuss the interrelationships between the various climatological and meteorological parameters and physical factors such as topography and vegetation for each of the resource areas.

4) <u>Characterize the Ambient Air Quality</u>

a) Provide a complete discussion of baseline ambient air quality based upon the following data summaries (as permitted by data availability) for the parameters listed in part 1.c. above:

(1) Annual maximum concentration

(2) Arithmetic or geometric annual means, as appropriate, with standard deviations

(3) Concentrations equalled or exceeded 10 percent, 50 percent, and 75 percent of the time on an annual basis

(4) Develop maps or figures depicting annual frequency of standards violation

(5) Seasonal arithmetic or geometric means as appropriate and maximum values.

b) Discuss available particle size distribution and chemical composition data of the particulate matter.

c) Identification of long term trends in ambient pollutant levels as defined by historical data.

d) Identification of areas of excellent (potential Class I areas) and degraded air quality.

e) Analysis of observed ambient pollutant levels in terms of Standards for the Prevention of Significant Deterioration (PSD).

f) Review the concept of air basins in light of observed regional trends of air pollutant levels.

g) Provide a discussion of the known impacts of observed pollutant levels on Wyoming flora and fauna.

h) Provide a discussion of applicable federal, state, and local air quality and emissions standards and a review of their potential impact in each district. The discussion will include such matters as PSD, Wyoming DEQ regulations, AQMA's, and 1977 amendments to the Clean Air Act.

i) Provide a map for each resource area showing the location of each data source.

5) <u>Characterize the Emissions Scenarios</u>

a) Provide a complete discussion of baseline emissions levels for point and area (district-wide) sources as well as source exit characteristics as described in part 1.d. above.

b) Evaluate observed district-wide and major point source emissions in terms of existing baseline ambient air quality.

c) Provide maps displaying the location of all major point sources.

d) Discuss available particle size distribution and chemical composition data from major point source measurements obtained in Wyoming.

6) <u>Provide a Bibliography of Raw Data Sources</u>

The list of sources should include the type of data available (if meteorological: temperature, precipitation, etc., and if air quality: TSP, SO_2, NO_x, etc.), the status of the data (mag tape, hand written, etc.), the location where the data was measured, and the person to be contacted should that information be desired.

7) <u>Provide a Bibliography of Available Climatological, Meteorological, Air Quality and Emissions Data in the Planning Area for Inclusion in the Inventory Reports</u>

8) <u>Prepare a Complete Glossary of Technical Terms for Inclusion in the Inventory Reports</u>

9) <u>Provide the BLM with a Copy of All Data in the Format Utilized by SAI from All Available Sources Used to Develop the Climatic and Air Quality Narrative, Maps, Tables, Etc.</u>

10) <u>Provide Written Monthly Progress Reports Within Two Weeks After the Completion of Each Calendar Month Together With a Discussion of the Attached Monthly Invoice.</u>

7.2 PROGRAM SCHEDULE

SAI proposes a time schedule for program completion in accordance with that requested by the BLM and as depicted in Figure 7-1. The dates for submission of the project documents are indicated below:

- Progress Reports - monthly
- Draft Report Climate, Dispersion Meteorology and Topography (including glossary and bibliography) - September 1, 1979
- Draft Report for Air Quality and Emissions (including glossary and bibliography) - November 1, 1979
- Draft Bibliography of Raw Data Sources - November 15, 1979
- Final Climate, Dispersion Meteorology and Topography Report - October 15, 1979
- Final Air Quality and Emissions Report - December 15, 1979
- Final Bibliography of Raw Data Sources - December 15, 1979.

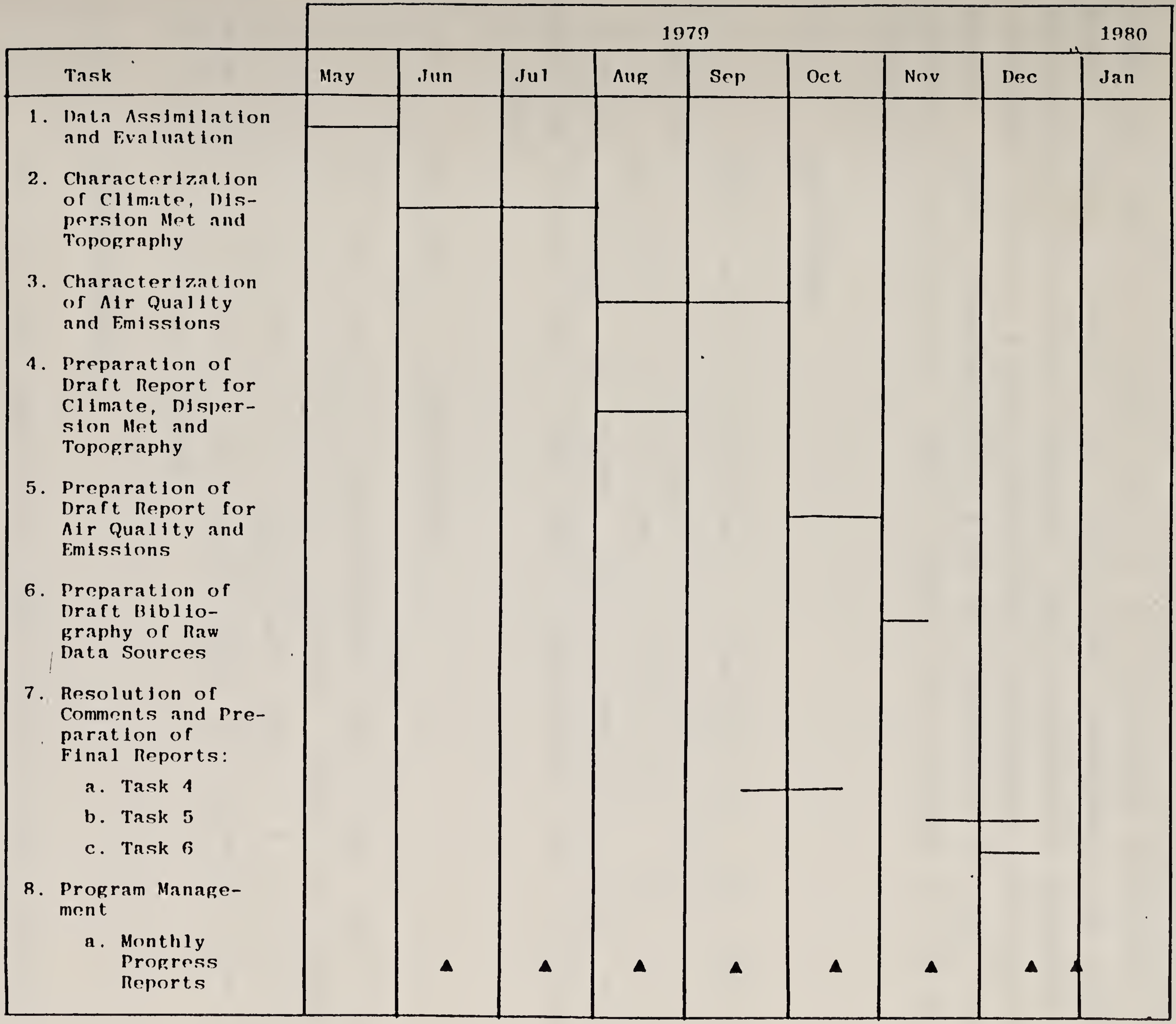

Figure 7-1

Study Project Schedule

7.3 KEY PERSONNEL

Mr. William P. Lynott will serve as the Program Manager, while Mr. Henry J. Frentz will be the Principal Scientist. Mr. Lynott and Mr. Frentz will be the key personnel who will be utilized on the present program. SAI is presently expanding the technical staff to include additional programmers and meteorologists. These personnel will also be considered for the present program as appropriate. Their resumes are included at the end of Section 7.

7.4 MAN-HOURS

This section provides a breakdown of the man-hours required for each of the major work areas presented in Section 7.1 by individuals in the form of Table 7-1. The man-hours described therein are based upon a contract period with a starting date of May 1, 1979 and a termination date of December 31, 1979.

7.5 MATERIALS AND EQUIPMENT

SAI will acquire meteorological data from the national Climatic Center and various other sources. Costs will depend on the actual availability of appropriate data. A cost estimate based upon preliminary discussions with NCC personnel has been provided in the cost proposal.

7.6 SUBCONTRACTORS

SAI will not subcontract any portion of the program.

7.7 TRAVEL REQUIREMENTS

State need of 6 trips - 2 people

It is estimated that a total of three (3) trips will be required to acquire data and interface with BLM staff. These

Table 7-1

Labor Requirements for the Wyoming Climate and Air Quality Study

Task Description	Individual	Man-Hours		Percentage Involvement*
1. Data Assimilation and Evaluation	Project Manager	8		5
	Principle Scientist	96		60
	Jr. Staff Scientist	64		40
	Programmer	48	224	30
	Technical Typist	8		5
2. Characterization of Climate, Dispersion Meteorology and Topography	Project Manager	64		20
	Principle Scientist	128		40
	Jr. Staff Scientist	128	528	40
	Programmer	176		55
	Technical Typist	32		10
3. Characterization of Air Quality and Emissions	Project Manager	64		20
	Principle Scientist	128		40
	Jr. Staff Scientist	128	352	40
	Programmer	0		0
	Technical Typist	32		10
4. Preparation of Draft Report for Climate Dispersion Meteor- ology and Topography	Program Manager	64		40
	Principle Scientist	96		60
	Jr. Staff Scientist	80	[illegible]	50
	Programmer	48		30
	Technical Typist	80		50
5. Preparation of Draft Report for Air Quality and Emissions	Program Manager	64		40
	Principle Scientist	96		60
	Jr. Staff Scientist	80	320	50
	Programmer	0		0
	Technical Typist	80		50
6. Preparation of Draft Bibliography of Raw Data	Program Manager	8		10
	Principle Scientist	32		40
	Jr. Staff Scientist	16	104	20
	Programmer	32		40
	Technical Typist	16		20
7. Resolution of Comments and Prep aration of Final Reports:	504			
a. Task 4	Program Manager	40		25
	Principle Scientist	64		40
	Jr. Staff Scientist	64	240	40
	Programmer	40		25
	Technical Typist	32		20

ask Description	Individual	Man-Hours		Percentage Involvement*
b. Task 5	Project Manager	40		25
	Principle Scientist	64		40
	Jr. Staff Scientist	64	200	40
	Programmer	0		0
	Technical Typist	32		20
c. Task 6	Project Manager	8		10
	Principle Scientist	24		30
	Jr. Staff Scientist	8	64	10
	Programmer	16		20
	Technical Typist	8		10
. Overall Program Management	Project Manager	120		10
	Technical Typist	60	180	5
. TOTALS	Project Manager	480-	12 - 3 4 1/2	40
	Principle Scientist	728	15 - 4	~60
	Jr. Staff Scientist	632	16 -	~50
	Programmer	360	9 · 2 1/4	30
	Technical Typist	380	10 · 2 1/2	~30

16 m·m·

1 1/3

1 1/2 yr

* Items 1, 4, 5, 7a and 7b are based upon a period of performance of 4 weeks (160 hours); Items 2 and 3 are based upon a period of performance of 8 weeks (320 hours); Items 6 and 7c are based upon a period of performance of 2 weeks (80 hours); Items 8 and 9 are based upon a total project performance period of 30 weeks (1200 hours).

trips would be taken by various staff members to most efficiently accomplish the effort.

7.8 COMPUTER TIME

SAI has estimated that four (4) hours of DEC-10 computer time will be required to complete the project. This will include data analysis, calculations and other tasks. Table 7-2 indicates the estimated computer breakdown by task.

Table 7-2

Computer Requirements

Task Description	Hours Required
1. Data assimilation and evaluation	1
2. Characterization of site climatology, air quality and project emissions	1 1/2
3. Dispersion meteorology	1 1/2
4. Preparation of final reports	0
Total	4

WILLIAM P. LYNOTT

Pennsylvania State University: B.S. Meteorology (1972)

Mr. Lynott serves as the Manager of the Meteorology and Air Quality Division at SAI. He is responsible for the management of climatological and meteorological baseline studies, monitoring programs, modeling efforts and impact analyses. Mr. Lynott has recently been involved in the management of climatological and air quality baseline studies for Alabama, California, and New Mexico for the Bureau of Land Management. He is also a work unit manager for an air quality impact analysis for the BLM project office handling the Northern Tier Pipeline System. These programs were defined under the terms of a Basic Ordering Agreement awarded to SAI. Mr. Lynott also serves as the environmental coordinator for a program designed to asses the impact of in-situ oil shale combustion technology for the Department of Energy.

Mr. Lynott is especially conversant with climatology and air pollution (diffusion) meteorology. He has participated in several SF_6 tracer programs including studies conducted at the Beaver Generating Station of the Portland General Electric Company and the San Onofre Nuclear Generating Station of Southern California Edison Company. He also directed tracer gas and ambient monitoring programs conducted for the Department of Transportation on automobile tunnels in Washington, D.C., and Mobile, Alabama. Mr. Lynott has prepared meteorological analyses for environmental reports and has served as principal investigator for the development of impact assessments for Army munitions facilities. Mr. Lynott has considerable experience relative to real-time monitoring programs and is participating in several ongoing programs in California and Wyoming.

Prior to joining SAI, Mr. Lynott served as an Environmental Engineer at the Southern California Edison Company. His specific duties included the management of the meteorological and air quality monitoring programs at the Mohave Generating Station, the San Onofre Nuclear Generating Station and the proposed Vidal Nuclear Generating Station. He also was responsible for site selection studies for fossil fuel and nuclear generating stations as well as the preparation of the meteorology and air quality sections for Environmental Impact and Safety Analysis Reports. Mr. Lynott is a member of the American Meteorological Society.

HENRY J. FRENTZ

Shepherd College, B.S., Mathematics (1972)
Pennsylvania State University, M.S., Meteorology (1978)

Mr. Henry J. Frentz is presently a staff meteorologist within the Meteorology and Air Quality Division of SAI. Mr. Frentz's educational experience has established his proficiency in synoptic and mesoscale meteorology and climatology. Prior to joining SAI, Mr. Frentz was a consulting satellite meteorologist with the National Oceanic and Atmospheric Administration and exercised a considerable degree of responsibility in dealing with clients throughout the world on the applications of satellite data to all phases of meteorology.

Since joining SAI in February 1978, Mr. Frentz has worked as lead investigator for Bureau of Land Management climate and air quality studies in Alabama. He was responsible for the collection, assimilation and analysis of meteorological, emissions and air quality data for use in establishing the environmental baseline in a four county area in Alabama. This study is to be used by the BLM in the preparation of a Land Use Study for minerals management.

Mr. Frentz has participated in gaseous tracer studies conducted off the southern California coast and in central Oregon. The former study was designed to aid in the analysis of the impact of a proposed oil platform to be installed by the Shell Oil Company; the latter project was designed to gauge the impact of large-scale agricultural burning in the Willamette Valley for the Oregon Department of Environmental Quality. Mr. Frentz has compiled a complete climatology of the San Diego, California area for an analysis of the impact of a proposed LNG storage facilities at Chula Vista, California and has prepared an analysis to determine the risks to a nuclear power plant from an LNG accident near Cove Point, Maryland. Mr. Frentz has also conducted a study to determine the effects of abnormal precipitation on buried transuranic waste near Idaho Falls, Idaho.

Mr. Frentz is currently principal meteorologist for a SAI program to determine the air quality impact of a Portland General Electric Co. power plant near Clatskanie, Oregon and is a member of the Quality Assurance Review Board for a SAI study to analyze the baseline air quality for a future coal production region in Southeastern Montana.

Mr. Frentz is a member of the National Weather Association and the American Meteorological Society. He is co-author of the book "A Basic Meteorology Exercise Manual" and was consultant to the National Geographic Society for their book "Powers of Nature".

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